Water 79-80

GB
1025
S383.A6
v.1979/80
WATERSUP
GW-Local

Santa Clara Valley Water District

GB 1025S383A61979/80c.4

SANTA CLARA VALLEY WATER DISTRICT

WATER CONDITIONS

ANNUAL REPORT

by

Isabel S. Gloege
Associate Civil Engineer

assisted by

Robert G. Bober, Jr.
Junior Civil Engineer

Geology and Water Quality Division

John T. O'Halloran
General Manager

David K. Gill
Water Supply Manager

DISTRICT BOARD OF DIRECTORS

Arthur T. Pfeiffer, Vice Chairman	District 1	James J. Lenihan, Chairman	District 5
Patrick T. Ferraro	District 2	Sig Sanchez	At Large
Robert W. Gross	District 3	Linda Peralta	At Large
Maurice E. Dullea	District 4		

21 R136tp

TABLE OF CONTENTS

		Page
I.	SUMMARY OF 1979-80 WATER CONDITIONS	1
II.	INTRODUCTION	2
III.	HYDROLOGIC BALANCE	4
IV.	GROUNDWATER	11
	A. Groundwater Levels	11
	B. Groundwater Recharge	13
	C. Land Surface Subsidence	13
	D. Groundwater Quality	14
V.	SURFACE WATER	17
	A. Precipitation	17
	1. Weather Modification	19
	B. Imported Water	20
	1. South Bay Aqueduct	20
	2. Hetch Hetchy	20
	3. San Felipe Project Status	22
	C. Water Conservation	22
	1. Local Storage Reservoirs	22
	2. Water Reclamation	23
	2.1 Water Reclamation Facility, Palo Alto	24
	2.2 Water Reclamation Facility, Gilroy	24
	2.3 Water Reclamation Study, Santa Clara Valley	24
	2.4 San Francisco Bay Area Regional Wastewater Reclamation Study	25
	3. Water Savings Program	25
	D. Surface Water Quality	26
	1. Streams	26
	2. Reservoirs	27
VI.	GLOSSARY	28

21R136tc

TABLES

		Page
1.	Water Use Summary - Santa Clara Valley Groundwater Subbasin	9
2.	Reservoir Storage on October 1, 1979 and September 30, 1980	23

FIGURES

Figure 1-A	Hydrologic Balance of Groundwater 1979-80	5
Figure 1-B	Hydrologic Balance of Groundwater 1979-80	6
Figure 2	Historical Water Supply and Use, Santa Clara Valley Subbasin	8
Figure 3	Water Supply and Use - Santa Clara Valley Groundwater Subbasin	10
Figure 4	Index of Groundwater Levels	12
Figure 5	Accumulated Annual Departure from 106-Year Average Rainfall at San Jose	18
Figure 6	Water Conveyance, Treatment and Distribution System	21

PLATES

1. Groundwater Basins and Water Zones
2. Lines of Equal Groundwater Elevation as Measured in Wells in September, 1980
3. Lines of Equal Change in Water Elevation in Wells from October 1979 to September 1980
4. Lines of Equal Depths to Water as Measured in Wells in September 1980

I. SUMMARY OF 1979-80 WATER CONDITIONS

During the period October 1, 1979 through September 30, 1980, precipitation was above average in the Santa Clara Valley, Coyote and Llagas subbasins. As a consequence, the volume of groundwater in storage in the subbasins increased over the previous year. The Santa Clara Valley subbasin at the end of 1979-80 showed an increase in the volume of groundwater in storage of 101 million [1/] cubic metres (82 thousand acre-feet). In the Coyote Groundwater Subbasin the volume of water in storage increased by three million cubic metres (2.4 thousand acre-feet) and the Llagas Groundwater Subbasin showed an increase of 25 million cubic metres (20 thousand acre-feet).

The volume of water stored in the District's conservation reservoirs increased during the same period by 84 million cubic metres (68 thousand acre-feet). All the reservoirs except Stevens Creek filled during the period of the report.

During the 79-80 fiscal year, the District imported 131 million cubic metres (106 thousand acre-feet) of water through the South Bay Aqueduct. The Rinconada Water Treatment Plant treated 60 million cubic metres (48 thousand acre-feet) of this water, the Penitencia Water Treatment Plant treated 28 million cubic metres (23 thousand acre-feet) and 43 million cubic metres (34 thousand acre-feet) was released for groundwater recharge or direct use. Hetch Hetchy deliveries to Santa Clara County amounted to 63 million cubic metres (51 thousand acre-feet) during 1979-80.

Significant subsidence has been effectively halted since 1969. This is the result of groundwater levels having risen above and having remained above the critical pressure elevation.

Groundwater continues to be high-quality water usable for all beneficial purposes although certain localized areas have yielded groundwater of poor mineral quality.

1/ One million cubic metres = 1×10^6 cubic metres
1×10^6 cubic metres = 811 acre-feet
1 acre-foot = 1,233 cubic metres

II. INTRODUCTION

One aspect of the District's water resources management program includes monitoring and evaluating water use and water supplies, analyzing and updating projected water needs, and planning and implementing projects to meet the needs of the County. A major objective of the management program is to coordinate and optimize the use of the District's total water supplies, including local surface water, groundwater, imported water, and reclaimed wastewater.

This annual report covers the period from October 1, 1979 to September 30, 1980. Its purpose is to inform the District Board of Directors and interested citizens of the current condition of the County's water resources. The report deals with all the components of the hydrologic cycle.

The three major groundwater subbasins, which are interconnected and occupy about 970 square kilometres (375 square miles or nearly 30 percent of the total County area), are the Santa Clara Valley, Coyote and Llagas Subbasins and are shown on Plate 1. Groundwater supplies about half of the total water used in the Santa Clara Valley Subbasin and almost all of that used in the Coyote and Llagas Subbasins. The remainder is supplied from local surface diversions and imported sources.

Zones of benefit have been established for the conservation, importation, treatment and distribution of water used in Santa Clara County and are shown on Plate 1.

Zone W-2 encompasses the Santa Clara Valley Groundwater Subbasin and was formed for the registration of those groundwater producing facilities that benefit from recharge of the groundwater basin by the District with local and imported water. In this zone, a charge is levied for groundwater extracted and the revenue thus derived is used to support the District's conservation and importation program.

Major sources of water supply income are the groundwater charge levied in Zone W-2 and the sale of treated water. The groundwater charge for nonagricultural uses during 1979-80 was $35.70 per thousand cubic metres ($44 an acre-foot), and for

agricultural uses the groundwater charge was $8.90 per thousand cubic metres ($11.00 an acre-foot). Treated water was sold at $68.90 per thousand cubic metres ($80 an acre-foot), with water in excess of contracted amounts sold at $48.60 per thousand cubic metres ($60.00 an acre-foot).

In 1979-80, the District received about one third of its revenue from ad valorem property taxes. Under Article XIII of the State Constitution (Proposition 13), the District no longer levied Water Fund, Zone W-3 or Zone W-4 taxes. Instead, it received a portion of the one percent Countywide tax revenue as allocated by the County Assessor in accordance with State Senate Bill 154. It did levy taxes to pay debt service on prior approved general obligation bonds with major debt service tax levied in Zone W-1 to repay general obligation bonds authorized in 1963. It also levied a State Water Project Tax throughout the County to pay for a portion of the costs of importing water from the State through the South Bay Aqueduct.

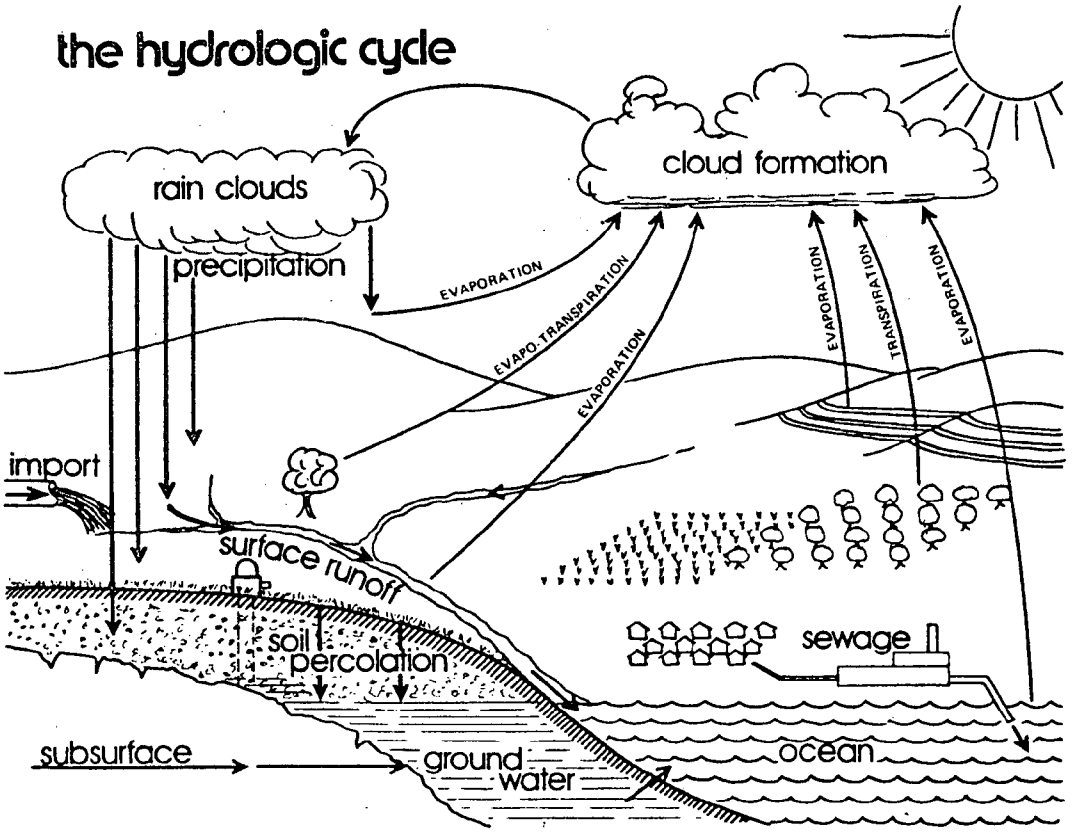
III. HYDROLOGIC BALANCE

Seasonal rainfall in Santa Clara Valley was above average in 1979-80. The San Jose Municipal Weather Station No. 86, which averages 359 millimetres per year, based on 106 years of record, recorded 478 millimetres (33 percent above normal). At Station No. 78 in Gilroy, which averages 491 millimetres, 639 millimetres were recorded (30 percent above normal).

All the conservation reservoirs were filled to capacity during the reporting period except Stevens Creek Reservoir. As of September 30, 1980, the amount of water in storage in all the reservoirs was 88 million cubic metres (71 thousand acre-feet) or 24 percent more than at the end of the preceding year.

With rainfall in 1979-80 above average, the volume of groundwater in storage in the Santa Clara Valley, Coyote and Llagas Groundwater Subbasins increased. As water levels rise and fall, the volume in storage changes. This change of stored water in the unconfined zone can be estimated by multiplying estimates of the storage capacity for the aquifer materials by the area and by the change in depth between groundwater levels at the beginning and end of the season. This year, water in storage in the Santa Clara Valley Groundwater Subbasin increased by 101 million cubic metres (82 thousand acre-feet). In the Coyote Subbasin, the volume of water in storage increased by three million cubic metres (2.4 thousand acre-feet) and in the Llagas Subbasin the volume of water in storage increased by 25 million cubic metres (20 thousand acre-feet).

These estimates were checked by balancing the hydrologic components of water supply and utilization. Water supply consists of precipitation, stream inflow, imported water, and subsurface inflow. Water is utilized or lost by consumptive use, sewage export, stream outflow, and subsurface outflow. The difference between supply and utilization is the net surplus or deficit of water in storage in the groundwater reservoirs at the end of the season. The hydrologic balance, illustrated in Figure 1, shows an increase in the Santa Clara Valley Subbasin of 101 million cubic metres (82 thousand



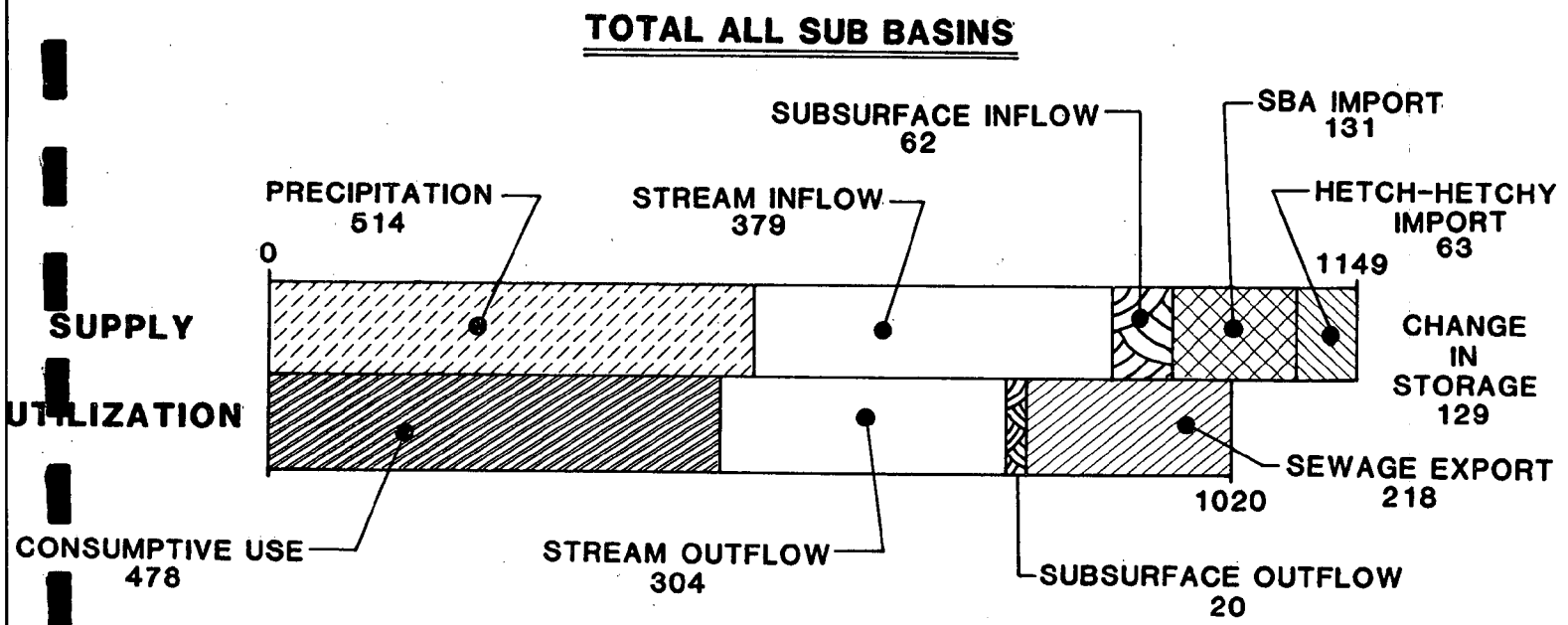
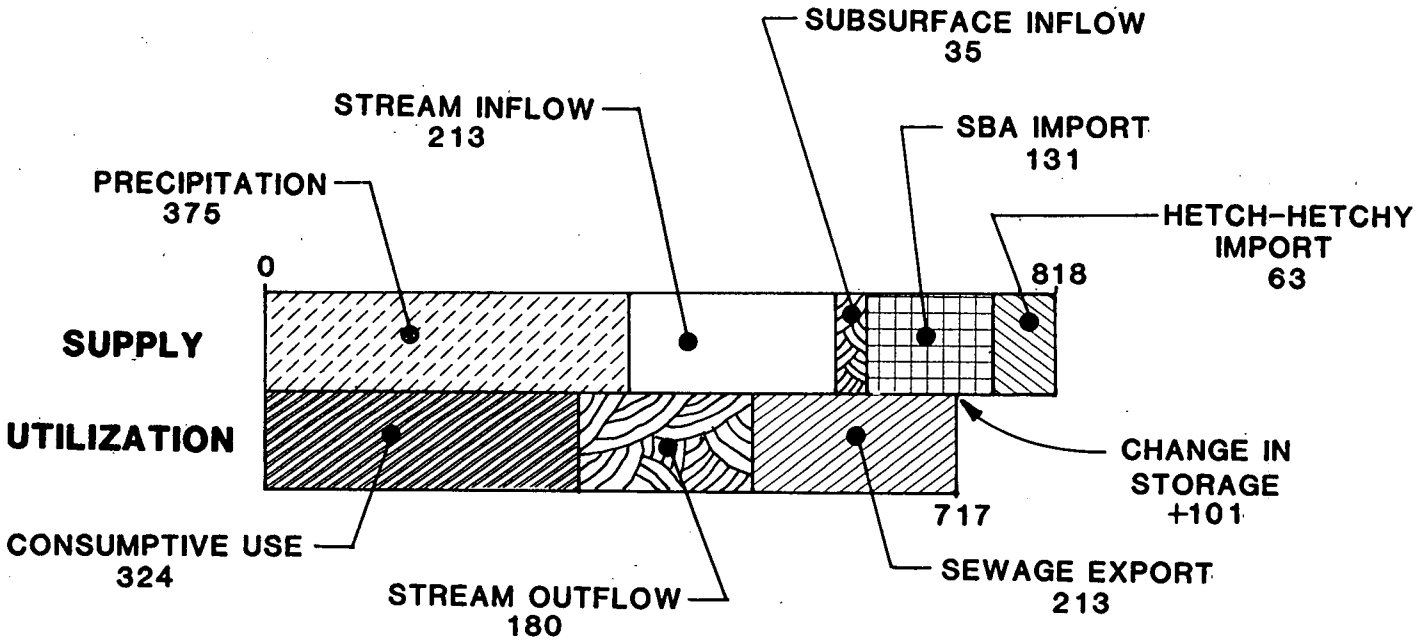
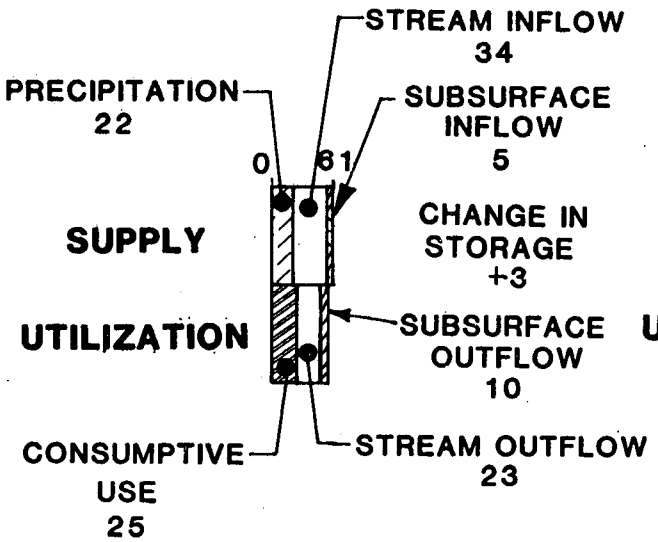


FIGURE 1-A HYDROLOGIC BALANCE OF GROUNDWATER 1979-80
(Values in million cubic metres)
One million cubic metres = 811 acre feet

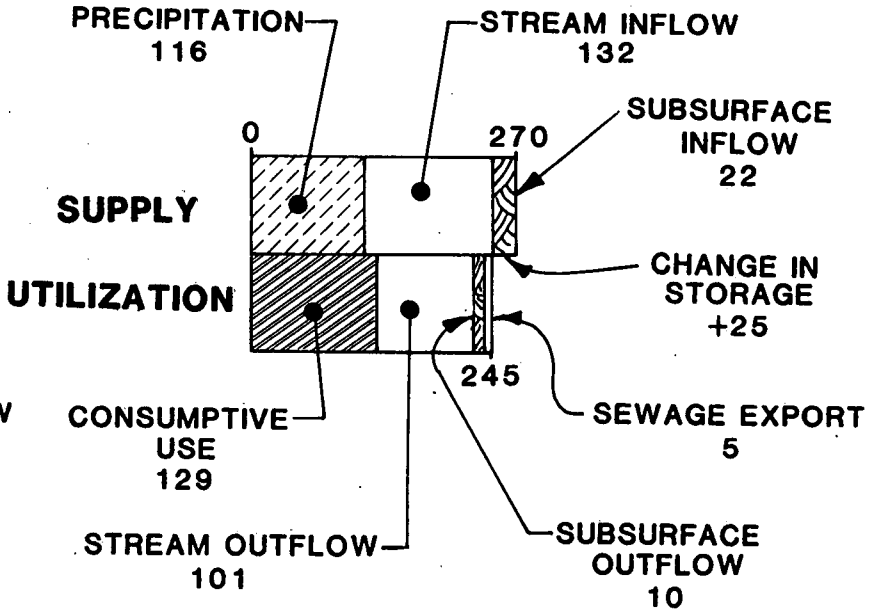
SANTA CLARA VALLEY G.W. SUB BASIN



COYOTE G.W. SUB BASIN



LLAGAS G.W. SUB BASIN



58

FIGURE 1-B HYDROLOGIC BALANCE OF GROUNDWATER 1979-80

(Values in million cubic metres)

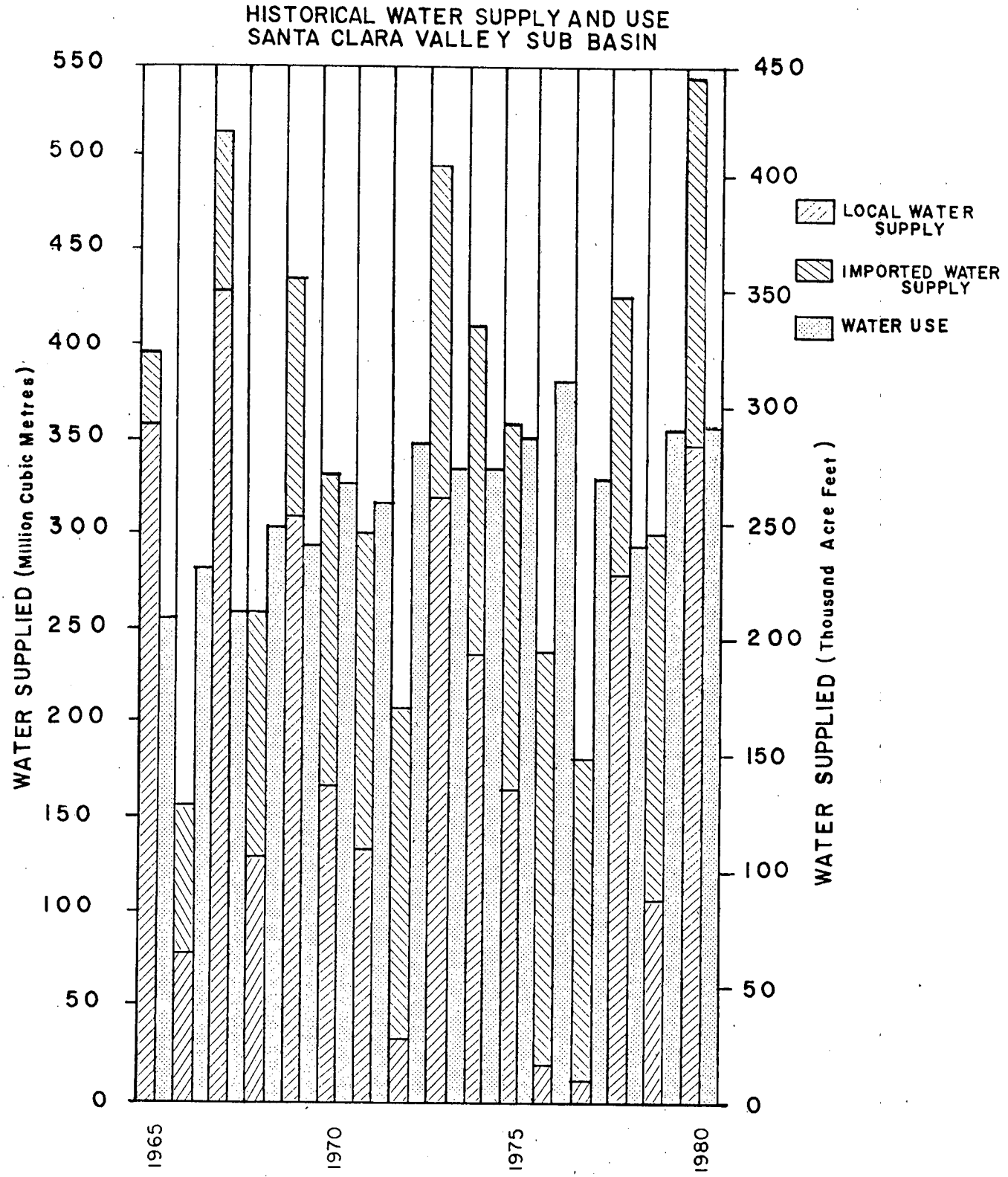
One million cubic metre 811 acre feet.

acre-feet), an increase in the Coyote Subbasin of three million cubic metres (two thousand acre-feet), and an increase in the Llagas Subbasin of 25 million cubic metres (20 thousand acre-feet. These compare favorably to the previously obtained increase of 101 million, three million and 25 million cubic metres for the Santa Clara Valley, Coyote and Llagas Subbasins respectively calculated using changes in groundwater elevation.

Shown on Figure 2 is the historical total amount of water supply available from local and imported sources and the total amount of water use for the period 1965 through 1980 in the Santa Clara Valley Subbasin area, and rainfall data for the same period.

Local water sources include groundwater produced from the Santa Clara Valley Groundwater Subbasin and surface water deliveries including San Jose Water Works diversions. The groundwater production does not include the amount of SBA water used for groundwater recharge which was 43 million cubic metres (35,000 acre-feet). The imported water deliveries consist of San Francisco Water Department water delivered through the Hetch-Hetchy Aqueduct, which began in Santa Clara County in 1952, and deliveries from the State Water Project through the South Bay Aqueduct which started in June 1965.

Actual water production in Santa Clara Valley Subbasin for the period 1970 through 1980 from all sources of supply is summarized in Table 1. Total supply and use for 1979-80 is illustrated in Figure 3.


HISTORICAL WATER SUPPLY AND USE
SANTA CLARA VALLEY SUB BASIN
WATER SUPPLIED (Million Cubic Metres)
WATER SUPPLIED (Thousand Acre Feet)
LOCAL WATER SUPPLY
IMPORTED WATER SUPPLY
WATER USE
0
50
100
150
200
250
300
350
400
450
500
550
0
50
100
150
200
250
300
350
400
450
1965
1970
1975
1980

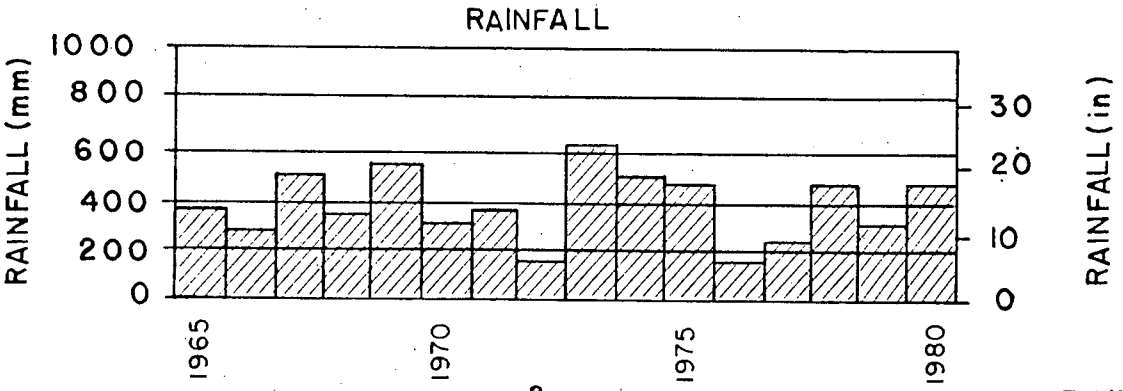

RAINFALL
RAINFALL (mm)
RAINFALL (in)
0
200
400
600
800
1000
0
10
20
30
1965
1970
1975
1980

FIGURE 2

TABLE 1

WATER USE SUMMARY

SANTA CLARA VALLEY GROUNDWATER SUB BASIN

(Values in million cubic metres) *

Fiscal Year	Surface Water Ag	Surface Water Non-Ag	Groundwater Ag	Groundwater Non-Ag	Distribution of SBA Import** Treated	Distribution of SBA Import** Untreated	Hetch Hetchy	SJWW Diversion	Total
69-70	6.0	1.0	36.1	154.3	48.3	0.6	59.6	19.5	325.4
70-71	5.4	1.4	29.2	153.3	54.3	0.9	55.7	15.9	316.1
71-72	5.9	1.9	29.6	175.3	60.2	1.0	61.5	10.9	346.3
72-73	5.2	2.0	21.6	169.9	55.5	0.7	60.3	18.0	333.2
73-74	3.7	2.2	19.6	159.1	56.1	0.7	64.4	25.7	331.5
74-75	4.3	2.3	20.8	148.5	83.1	0.7	65.8	21.6	347.1
75-76	6.2	2.5	24.7	183.1	81.5	1.0	70.0	10.5	379.5
76-77	3.1	1.9	20.6	167.8	74.5	0.9	58.8	0.9	328.5
77-78	3.0	1.9	14.4	142.3	73.4	1.0	46.0	12.3	294.3
78-79	3.1	2.4	14.8	169.8	82.3	0.8	62.4	19.1	354.7
79-80	2.7	1.7	12.1	171.8	88.0	0.8	62.9	17.7	357.7

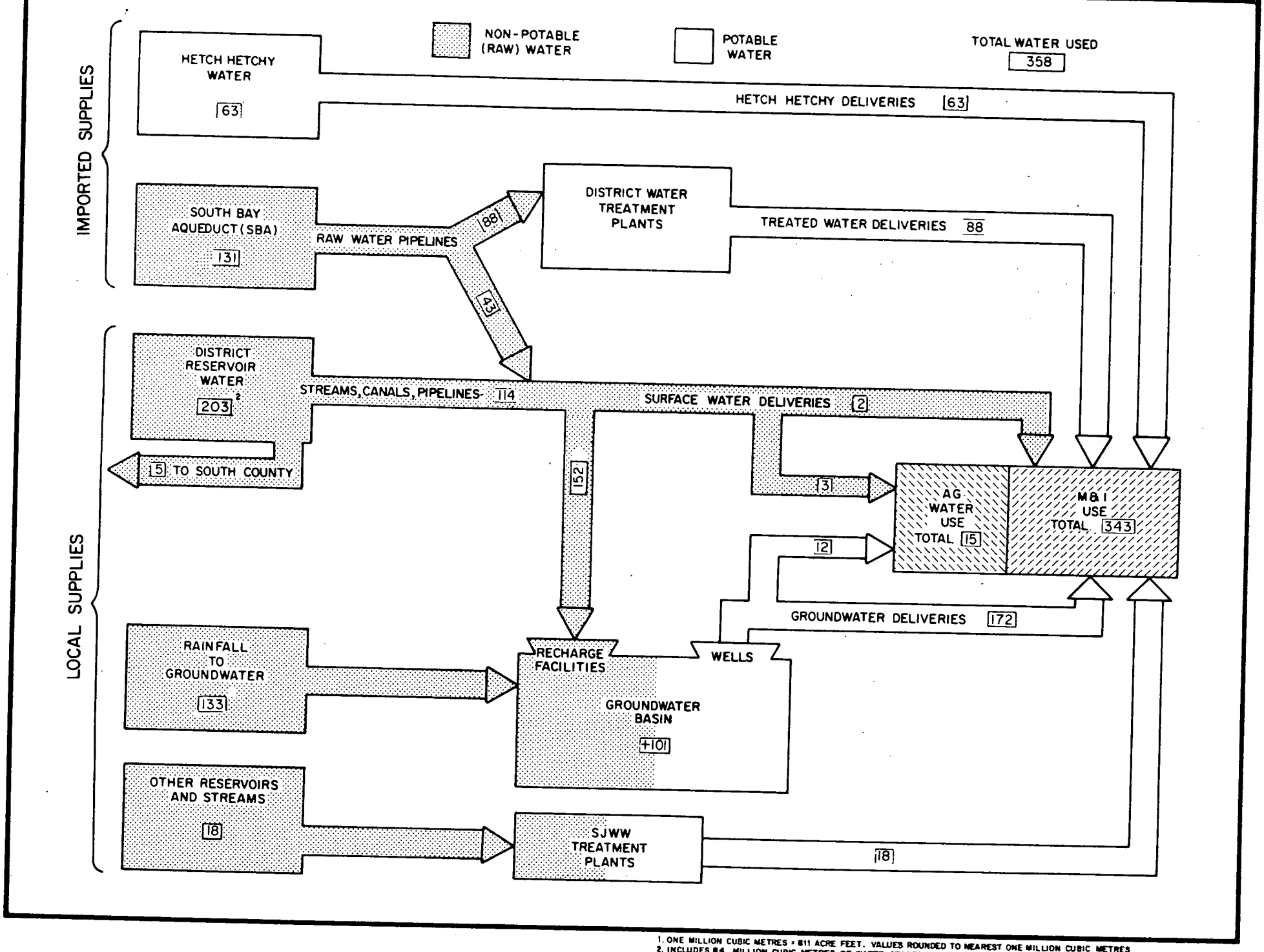
* One million cubic metres = 811 acre-feet.

** Imported SBA Water recharged to the groundwater basin included in groundwater used (43 million cubic metres).

WATER SUPPLY AND USE

Santa Clara Valley Groundwater Sub Basin

Value[redacted]llion [redacted]metre[redacted]



1. ONE MILLION CUBIC METRES = 811 ACRE FEET. VALUES ROUNDED TO NEAREST ONE MILLION CUBIC METRES
2. INCLUDES 84 MILLION CUBIC METRES OF WATER STORED IN RESERVOIRS.
3. INCLUDES UNMEASUREABLE SUBSURFACE INFLOW.

FIGURE 3

IV. GROUNDWATER

A. Groundwater Levels

A groundwater contour map, showing lines of equal elevation of water levels in wells as of September 1, 1980 (traditionally the seasonal low) is shown on Plate 2. Plate 3 shows lines of equal change in elevation of water in wells between September 1979 and September 1980. Plate 4 shows lines of equal depth to water as of September 1, 1980. These groundwater contours are based on information from more than 352 wells.

The change in groundwater storage is obtained by use of Plate 3, Map of Equal Change in groundwater levels. Groundwater levels (determined from the unconfined area of the groundwater contour map) for the Santa Clara Valley Subbasin show an increase of six metres (20 feet) from 1979 levels, the Coyote Subbasin show an increase of two metres (seven feet) and the Llagas Subbasin an increase of six metres (20 feet).

An index of the monthly fluctuation of water levels from 1963 to 1980 in the Santa Clara Valley, Coyote, and Llagas Subbasins is presented in Figure 4. Well Nos. 07S01E07R99 and 10S03E13D03 are the well hydrographs used to represent trends in the Santa Clara Valley and Llagas Groundwater Subbasins, respectively. The Coyote Subbasin is represented on Figure 4 by the weighted average depths to water in four representative wells, which are monitored at the beginning of each month. These weighted averages are indexes and as such do not represent the actual depth to water at any point within this basin. The intent of Figure 4 is to show trends in the change of groundwater levels in the subbasins over the years.

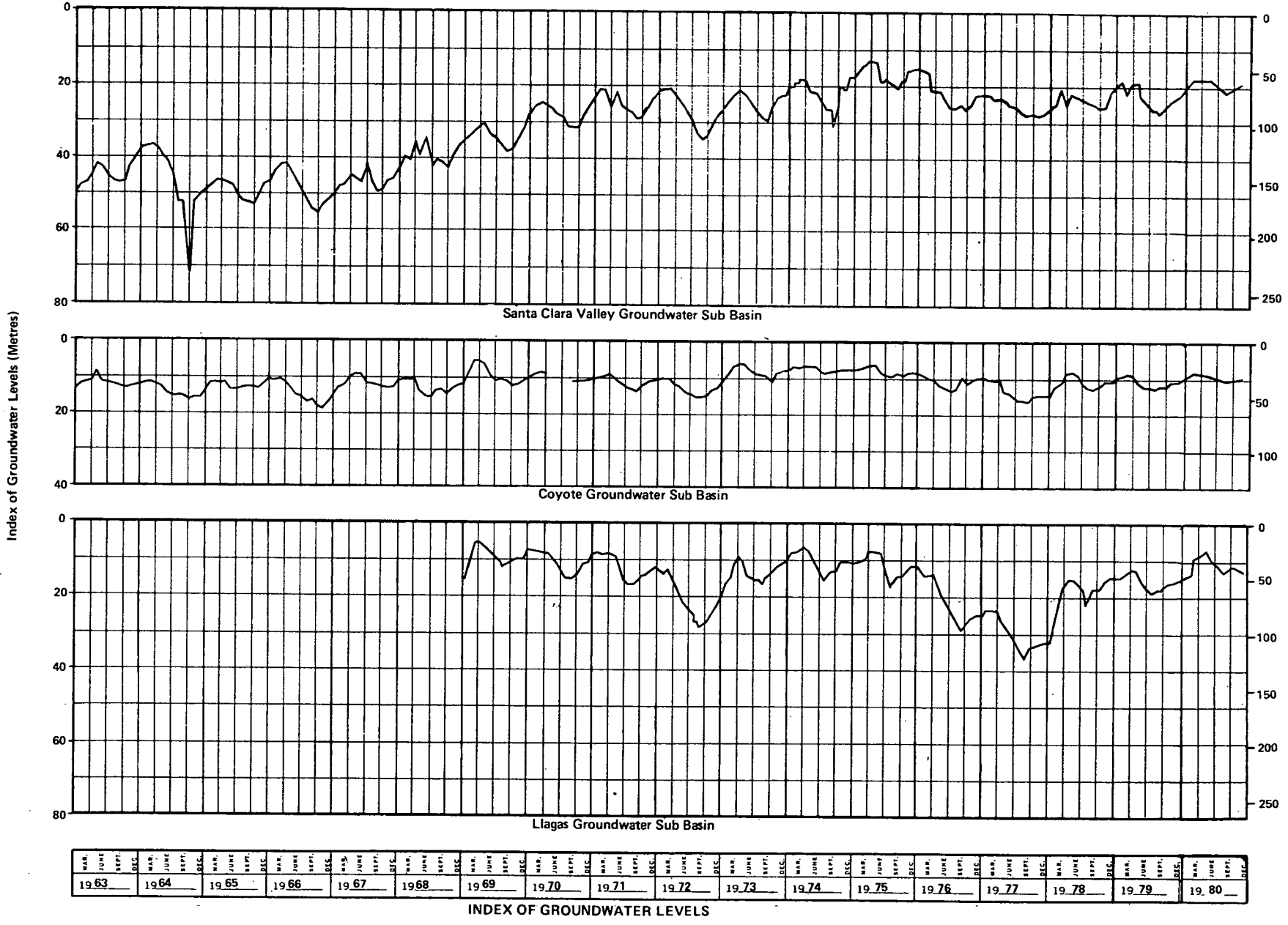

Index of Groundwater Levels (Metres)
Index of Groundwater Levels (Feet)
Santa Clara Valley Groundwater Sub Basin
Coyote Groundwater Sub Basin
Llagas Groundwater Sub Basin
0
20
40
60
80
0
50
100
150
200
250
MAR.
JUNE
SEPT.
DEC.
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
INDEX OF GROUNDWATER LEVELS

Figure 4

B. Groundwater Recharge

The District, as part of its ongoing water management program, recharges the Santa Clara Valley, Coyote, and Llagas Groundwater Subbasins with local and imported water.

In 1979-80, 152 million cubic metres (123 thousand acre-feet) of water were recharged in the Santa Clara Valley Subbasin, which is a 24 percent increase over the 120 million cubic metres (97 thousand acre-feet) recharged in 1978-79. This was due to above-average rainfall during the 1979-80 period. About 109 million cubic metres (88 thousand acre-feet) of water were recharged from reservoir supplies and about 43 million cubic metres (35 thousand acre-feet) were recharged from imported South Bay Aqueduct water. Additionally, five million cubic metres (four thousand acre-feet) of water were recharged in the Coyote and Llagas Subbasins from Anderson Reservoir through the Main Avenue and Madrone Channel Recharge Facilities.

C. Land Surface Subsidence

Subsidence of the land surface occurs when intensive groundwater pumping results in lowered water pressures in the groundwater basin materials. This increases the effective overburden load on the clay materials in and separating aquifers. As a result, the clay materials compact with consequential sinking of the overlying land surface. The District established a single level circuit around the south end of San Francisco Bay that was run annually from 1963 to 1976. This line of levels has not been run since 1976 because the amount of land surface subsidence was less than the accuracy of the leveling.

In 1960, the U.S. Geological Survey installed extensometers (compaction recorders) in 305 metre (1,000 feet) cased holes at the centers of subsidence, one in San Jose and another in Sunnyvale. These extensometers have recorded compaction of the confined aquifer system for 20 years.

Records from these instruments show that the compaction measured to a depth of 305 metres is about equal to the land surface subsidence as measured periodically by leveling of the bench marks.

According to Poland, "The subsidence in the Santa Clara Valley of California has been stopped by raising the artesian head in the aquifers until it equaled or exceeded the maximum pore pressures in the aquitards. The compaction and water-level records being obtained by the Geological Survey indicate that if the artesian head can be maintained 10 to 20 feet above the levels of 1971-73, subsidence will not recur. On the other hand, subsidence will recommence if the artesian head is drawn down as much as 20 to 30 feet below the 1971-73, levels."[1/] At the Santa Clara Valley Subbasin index well this level is 45 metres (140 feet) below the ground surface.

D. Groundwater Quality

To aid in the management and protection of the quality of all the waters in the valley, the District is monitoring the quality of waters in the underground subbasins, streams, and the surface reservoirs. Further, in order to help prevent degradation of the groundwater in Santa Clara County, the District has adopted well construction and destruction standards (SCVWD Ordinance No. 75-6). The purpose of these standards is to protect and preserve the groundwater supply for future uses.

Groundwater pumped from most of the existing wells in the County is of good quality and, in general, meets drinking water standards. Groundwaters from properly constructed and protected wells, including many municipal well fields, are usually used directly without chlorination.

Generally, groundwater may be classified as moderately to extremely hard. Hardness of water is caused principally by some compounds of calcium and magnesium.

1/ Poland, Joseph F., "Land Subsidence in Santa Clara Valley, California", Water Spectrum, Department of the Army, Spring 1978, Vol. 10, No. 2.

Certain localized areas have yielded groundwater of poor quality as a result of contamination from surface waters or degradation from subsurface sources. In the summer of 1979 the Department of Water Resources found high levels of nitrates in the San Martin area, confirming earlier findings of the Central Coast Water Regional Quality Control Board. A special water quality study in the San Martin area was completed by a consultant under the direction of Santa Clara County Planning Department. The study concluded that the quality of the water in this area is generally good except for high nitrate content. The principal sources of nitrates entering the Llagas groundwater subbasin in San Martin were found to be effluent from individual waste treatment and disposal systems and nitrate from fertilizers carried by irrigation water that percolates through the soil.

Another area of groundwater degradation is in the Santa Cruz Mountains above Lexington Reservoir where the Santa Clara County Health Department has obtained samples of water from domestic wells that does not meet drinking water standards. Information gathered from surveys conducted showed that the source of groundwater contamination were on-site treatment and disposal wastewater systems which were not maintained or were designed with insufficient capacity for the present loading. In addition, many original septic tanks have deteriorated and collapsed and leach field pipes have been crushed. Several alternative solutions are being studied by the Santa Clara County Board of Supervisors.

Another groundwater quality concern is saltwater intrusion into fresh aquifers. Saltwater intrusion has occurred in aquifers along the baylands area bordering south San Francisco Bay in Santa Clara County. Recognizing the problem, SCVWD conducted a study to assess existing condition and to evaluate possible actions that were required to prevent or minimize further intrusion. They found that presently, saltwater is mostly contained within the upper aquifer (above 50 metres in depth), however, some areas of the main aquifer (below 50 metres) also contain saltwater. Saltwater is most likely

finding its way through defective or improperly sealed or abandoned wells. Based upon these findings, SCVWD staff designed a project to alleviate this situation, which was submitted for grant funding and approved, under the State Clean Water Assistance Program. The project is expected to take three years to complete and will cost about $350,000 of which about $238,000 will be grant funded.

The project objective is to locate and have sealed or repaired old wells which were not properly constructed or maintained or have been abandoned or destroyed and are probably providing conduits for interaquifer transfer of saltwater. This will prevent or substantially reduce the possibility of further degradation of the lower aquifer.

V. SURFACE WATER

A. Precipitation

Rainfall is the source of all locally developed water supplies. The long-term precipitation at San Jose is illustrated in Figure 5 as the accumulated departure from the mean which denotes graphically the wet and dry periods of rainfall. The important feature in Figure 5 is the slope of the line; particularly whether it is positive (up) or negative (down). Each point is plotted as a difference from the long-term average; a wet year showing a positive difference and a dry or below normal rainfall year indicating a negative difference. If each difference is added to that of the previous year, a trend of positive or negative increments becomes apparent. An upward trend would, therefore, indicate a period of years which have received above normal rainfall and a downward trend would be indicative of a below normal period.

The accumulated departure from the mean is used to identify long-term wet and dry periods. Despite short term fluctuations, the long-term periods are easily discernible.

Beginning in 1875, rainfall approximated the long-term average until 1890 when a series of wet years began which generally continued until about 1916. The valley experienced low rainfall for several years following 1920 until 1935. It was during this drought period that valley residents first initiated a comprehensive water conservation program. The completion of the valley's first five water supply reservoirs in 1935 coincided with the beginning of a short interval of above-average rainfall. This enhanced the water supply picture and enabled groundwater levels, which had been declining, to recover.

Between 1943 and 1962, another series of dry years occurred. From 1962 to 1975, the valley has had rainfall slightly above the long-term average. However, since 1975, except for 1977-78 and 1979-80 rainfall was below average.

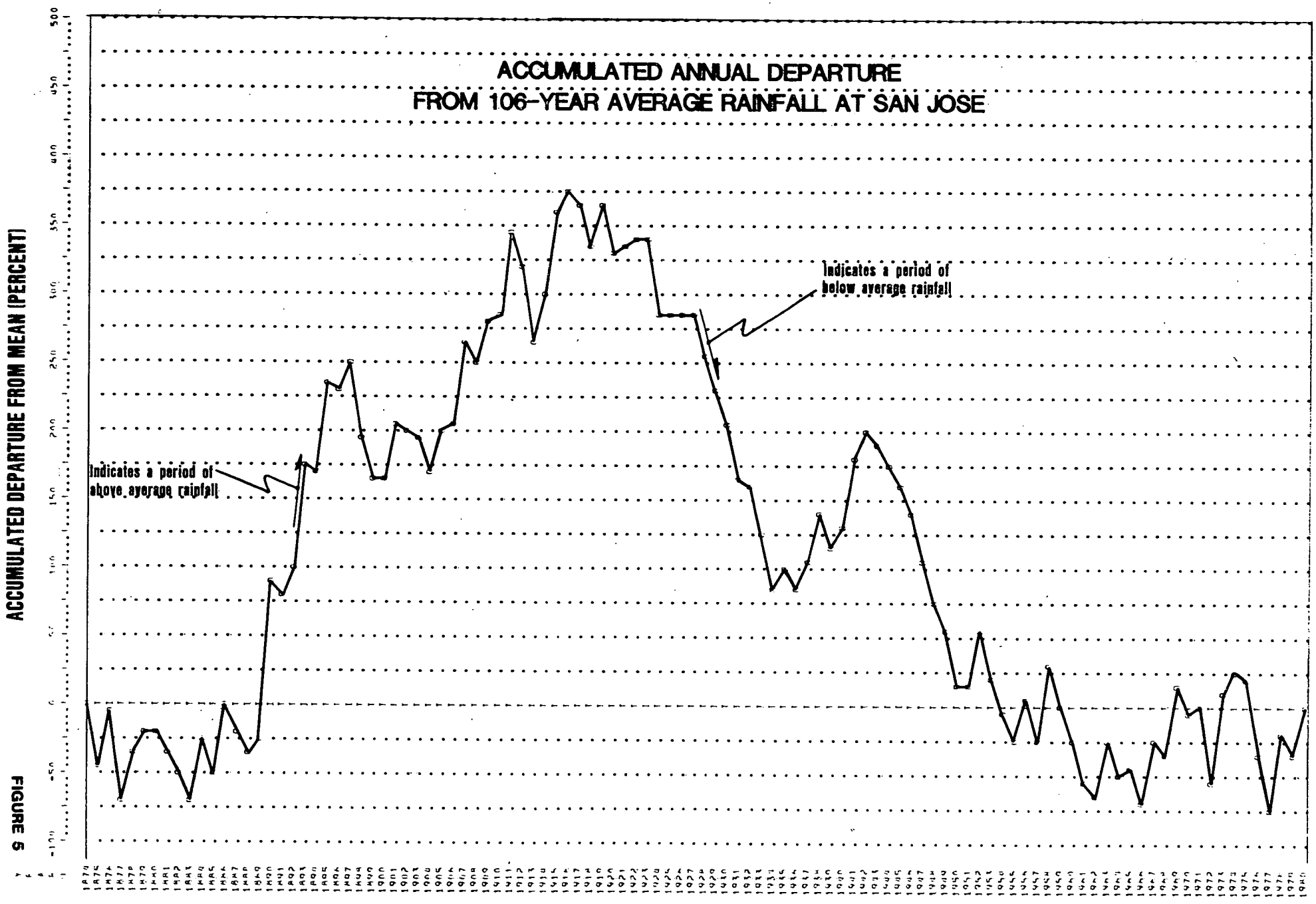

ACCUMULATED ANNUAL DEPARTURE
FROM 106-YEAR AVERAGE RAINFALL AT SAN JOSE
ACCUMULATED DEPARTURE FROM MEAN (PERCENT)
Indicates a period of above average rainfall
Indicates a period of below average rainfall

FIGURE 5

1. Weather Modification

In its search for additional means of increasing its water supply, the District has been conducting cloudseeding operations since December of 1951.

Under natural conditions only a small amount of the moisture passing over the valley in the form of clouds ever reaches the ground as rain or snow. The function of a cloudseeding program is to increase total precipitation by introducing artificial nuclei into the clouds at the proper time and location.

The basic conditions for successful operation of the District's weather modification program occur when moisture-laden air masses from the Pacific Ocean are driven over the Santa Cruz Mountains by the westerly and southwesterly winds that prevail during storms. As these air masses approach the mountains, they are forced to rise abruptly, producing turbulence and rapid vertical velocities. When cloud droplets rapidly rise to altitudes above the freezing level, they form into ice crystals on dust, hydrocarbon particles, and other substances. When these ice crystals fall to an elevation where the temperature is above the freezing point, they melt, thereby forming raindrops which continue to collect moisture and grow larger as they fall to earth.

Minute crystals of silver iodide (AgI) also act as nucleating agents and are effective at higher temperatures than natural nuclei. One gram of silver iodide produces millions of nuclei.

Ground-based generators located to the west and south of the main watersheds are used to produce the nuclei which are carried aloft by the rising air currents passing over the mountains.

Cloudseeding is a rain-increasing and not a rain-making process. During dry years, few, if any, opportunities exist for seeding. An increase in seasonal rainfall has been indicated to range between 10 percent and 15 percent for those years when cloudseeding was conducted.

In the 1979-80 season, two storms were seeded between December 1979 and February 1980 with a total of 67 generator-hours for the period and the use of 1,669 grams of silver iodide.

B. Imported Water

The existing and proposed water import conveyance, treatment and distribution system for Santa Clara Valley is shown in Figure 6.

1. South Bay Aqueduct

The primary source of imported water for Santa Clara County is the South Bay Aqueduct. In 1979-80, 131 million cubic metres (106 thousand acre-feet) of water was delivered into Santa Clara County through this facility. Of this total, 60 million cubic metres (48 thousand acre-feet) was treated at the Rinconada Water Treatment Plant and 28 million cubic metres (23 thousand acre-feet) was treated at the Penitencia Water Treatment Plant for delivery to consumers through retail water agencies. In addition, one million cubic metres (700 acre-feet) of raw water was delivered directly from District pipelines for use by individual contractors. The remaining 43 million cubic metres (35 thousand acre-feet) was recharged into the underground water supply through the District's recharge facilities.

2. Hetch Hetchy

San Francisco Water Department's Hetch Hetchy Aqueduct provides a second source of imported water. During the fiscal year 1979-80, this system delivered 63 million cubic metres (51 thousand acre-feet) directly to the water supply systems of the Cities of Milpitas, San Jose, Sunnyvale, Santa Clara, Mountain View, and Palo Alto and to the Purissima Hills County Water District. Small amounts of this water were also delivered to Stanford University, NASA, Moffett Field, Agnews State Hospital, and other local contractors.

SAN FRANCISCO BAY
SCVWD RECLAMATION FACILITY-PALO ALTO
CALAVERAS RESERVOIR (SFWD)
MILPITAS RESERVOIR
HETCH HETCHY CONNECTION
HETCH HETCHY AQUEDUCT (SFWD)
SOUTH BAY AQUEDUCT (DWR)
NO. SAN JOSE DISTRIBUTARY
MILPITAS PIPELINE
PENITENCIA TREATMENT PLANT EXPANSION
MT. VIEW DISTRIBUTARY
WEST PIPELINE EXTENSION
SUNNYVALE DISTRIBUTARY
WEST RESERVOIR AND DELIVERY MAIN
SANTA CLARA DISTRIBUTARY
CAMPBELL DISTRIBUTARY
CENTRAL PIPELINE
EAST PIPELINE
EAST RESERVOIR AND DELIVERY MAIN
EVERGREEN CANAL
PARALLEL WEST PIPELINE
STEVENS CREEK RESERVOIR
STEVENS CREEK PL
WEST PIPELINE
EVERGREEN PUMP STATION
SNELL AVE. PIPELINE
COYOTE CANAL
RINCONADA TREATMENT PLANT EXPANSION
ALMADEN PIPELINE I
RINCONADA FORCE MAIN
VASONA RESERVOIR
SANTA TERESA WTP
ALMADEN PIPELINE II
COYOTE
ALAMITOS
CANAL
VASONA PUMP STATION EXPANSION
GUADALUPE RESERVOIR
CALERO PIPELINE
LEXINGTON RESERVOIR
ALMADEN CALERO CANAL
ALMADEN RESERVOIR
CALERO PUMP GENERATING FACILITY
CALERO DAM AND RESERVOIR ENLARGEMENT
CROSS VALLEY PIPELINE
HALF ROAD PIPELINE
CHESBRO RESERVOIR (GWCD)
MORGAN HILL PIPELINE
UVAS RESERVOIR (GWCD)
UVAS LLAGAS CONDUIT (GWCD)
MADRONE-LLAGAS PIPELINE
UVAS CONDUIT
UVAS RECHARGE FACILITY
WATER RECLAMATION FACILITY-GILROY (SCVWD/GILROY/GWCD)
GILROY PIPELINE
SANTA CLARA CONDUIT (WPRS)
COYOTE PUMP STATION (WPRS)
ANDERSON RESERVOIR
MADRONE CHANNEL
MAPLE AVE. RECHARGE FACILITY AND PIPELINE
SAN MARTIN PIPELINE
COYOTE RESERVOIR
SAN MARTIN W.T.P.
SANTA CLARA CONDUIT (WPRS)
HOLLISTER CONDUIT (WPRS)
SANTA CLARA TUNNEL (WPRS)
PACHECO RESERVOIR (PPWD)
PACHECO PUMPING PLANT (WPRS)
SAN LUIS RESERVOIR (WPRS/DWR)
PACHECO TUNNEL (WPRS)
PACHECO CONDUIT (WPRS)
N
LEGEND
EXISTING FACILITIES
PROPOSED FACILITIES
RECHARGE FACILITY
WATER TREATMENT PLANT
PUMP STATION
RESERVOIR
PIPELINE
Santa Clara Valley Water District
WATER CONVEYANCE, TREATMENT AND DISTRIBUTION SYSTEM
FEBRUARY, 1981
PREPARED BY ADVANCED PLANNING DIVISION

FIGURE 6

3. San Felipe Project Status

As of September 30, 1980, excavation on the 8.6-kilometre (5.3-mile) section of the Pacheco Tunnel of the San Felipe Division facilities was about 80 percent completed.

Concurrent with the work of the Bureau of Reclamation construction of the Almaden Valley Pipeline Unit II, shown in Figure 6, is underway. The Cross Valley Pipeline is being designed and will distribute San Felipe and local water in Santa Clara County.

C. Water Conservation

The term "Water Conservation", as used in this report, refers to programs to manage and make the best use of water available to the District from all sources. "Water Savings" refers to efforts to reduce water use, a part of any water conservation program, and is discussed later in this section of this report.

The District's water conservation program, an integral part of its overall water management activities, includes local water storage facilities, wastewater reclamation, and water savings programs.

1. Local Storage Reservoirs

The District has constructed storage reservoirs on most of the major streams to retain seasonal runoff which later is released for groundwater recharge and direct surface irrigation. The District owns and operates eight dams and reservoirs with a combined capacity of about 190 million cubic metres (155,000 acre-feet). Other public agencies in the County have constructed additional reservoirs with a total storage capacity of about 30 million cubic metres (24,000 acre-feet). Another significant storage reservoir is San Jose Water Works' Lake Elsman with a capacity of about nine million cubic metres (7,500 acre-feet).

Table 2 shows the capacity and percent full of all the reservoirs on October 1, 1979 and on September 30, 1980. In September 30, 1980, the total amount of water stored in all these reservoirs was 88 million cubic metres more than on October 1, 1979.

TABLE 2

RESERVOIR STORAGE

Reservoir	Capacity: Million Cubic Metres	Capacity: Acre-Feet	Percent Full: Oct. 1, 1979	Percent Full: Sept. 30, 1980
Almaden	2.2	1,800	12.5	86.4
Anderson	112.6	91,300	23.3	83.3
Calero	12.5	10,200	16.2	77.1
Chesbro*	10.0	8,100	17.9	1.8
Coyote	29.2	23,700	59.2	6.9
Guadalupe	4.6	3,700	8.5	11.7
Lexington	24.9	20,200	23.5	31.6
Pacheco**	7.6	6,100	0	19.9
Stevens Creek	4.4	3,600	4.9	11.7
Uvas*	12.3	10,000	21.1	71.5
Vasona	0.5	400	87.0	86.2

* Gavilan Water Conservation District's Reservoirs

** Owned by Pacheco Pass Water District

Of these 88 million cubic metres, five million cubic metres correspond to the increase in storage in Gavilan Conservation District reservoirs.

2. Water Reclamation

In its search for new sources of water, the District, as early as 1958, engaged a private consultant to explore methods of reclamation of sewage and industrial wastewater. An oxidation pond was constructed adjacent to the San Jose Water Pollution Control Plant. Tests were conducted over a two-year period yielding valuable information for future efforts.

Presently, two water reclamation plants are in operation and other studies are being conducted as described below.

2.1 Water Reclamation Facility, Palo Alto

Operation of the Palo Alto Reclamation Facility began in June 1977. This facility can produce high-quality water at a rate of four million gallons daily by providing advanced wastewater treatment to effluent from the adjacent regional water quality control plant.

During 1979-80, 437 cubic metres (0.35 acre-feet) of reclaimed water were sold to CALTRANS and the City of Palo Alto.

2.2 Water Reclamation Facility, Gilroy

The wastewater reclamation facility in Gilroy was constructed under an emergency program to combat the severe overdraft of a limited underground reservoir and meet the need for new water supplies in the Gilroy area during the drought.

The facility was constructed jointly by the Santa Clara Valley Water District, the City of Gilroy, and the Gavilan Water Conservation District.

The treatment system takes primary effluent from the City of Gilroy plant and provides secondary treatment in an oxidation pond.

The recycled water is used for agriculture and landscape irrigation. During 1979-80, 334 thousand cubic metres (271 acre-feet) were sold.

2.3 Water Reclamation Study, Santa Clara Valley

The purpose of this study is to determine the feasibility of reclaiming wastewater to augment water supplies in Santa Clara County. This study was conducted jointly by the Santa Clara Valley Water District and the Department of Water Resources. The study has investigated the possibility of surface delivery of reclaimed water for irrigation and agricultural lands in South County (Phase IA) and the feasibility of distributing reclaimed water by recharging it into the groundwater basins (Phase IB). A report of Phase IA of the study was completed in December 1980, which concluded that direct delivery of reclaimed water for irrigation of agriculture is not financially feasible without large subsidies.

2.4 San Francisco Bay Area Regional Wastewater Reclamation Study

The San Francisco Bay Area Water Reuse Study is sponsored by a 14 member Joint Powers Agency including Santa Clara Valley Water District.

This study is a two-phase study to develop a regional long-range wastewater reclamation facilities plan which will provide for the maximum reuse of Bay Area wastewater and recommend an implementation program consistent with on-going and proposed subregional programs.

A report on Phase I was completed in May 1979. It identified the major potential markets for reuse of Bay Area wastewater and recommended that the Water Reuse Study be continued into Phase II.

Phase II of the water reuse study will complete the evaluation of four general markets with the greatest potential for using reclaimed water on a large scale. A detailed evaluation of two project concepts that appeared to be most feasible was completed in June 1980. These markets were agricultural use in southern San Joaquin Valley and salinity control in the Sacramento-San Joaquin delta.

3. Water Savings Program

Water savings is and always has been an integral part of the District's overall water supply program. During the drought, the program effort was increased in conjunction with the District's Board of Directors' call for all citizens to voluntarily reduce water use by 25 percent.

Subsequent to the above average rainfall of 1977-79, when it became apparent that an adequate water supply was available for meeting the County's population water needs, the District reduced its emergency goal of a 25 percent reduction in water use and established a goal to maintain permanently a water savings of at least ten percent on the basis of pre-drought levels of use in order to ensure a balanced water supply for the future. The water savings program continues with this new goal in mind. The water savings program is needed especially until San Felipe water becomes available.

D. Surface Water Quality

1. Streams

Surface waters of the Santa Clara Valley are generally of adequate mineral quality.

The stream surface water quality monitoring program in 1979-80 included data collected from ten stream sampling stations. The stream monitoring stations were located at existing streamflow stations and were sampled during the report period for specific conductance, pH, temperature, DO, hardnesses, Ca, Mg, Na, SAR, sodium percent, K, alkalinity, SO_4, Cl, F, SiO_2, solids, total, dissolved N (NO_2 NO_3 NH_3 and organic) total phosphorus, dissolved metals (Al, B, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn), and TOC.

Except for the metals and TOC which were measured twice, all the other parameters were measured eight times during the report period. The stream monitoring stations are located at the following stream flow stations:

Los Gatos Creek

Station 67	-	below Lexington Reservoir
Station 59	-	at Lark Avenue
Station 50	-	at Lincoln Avenue

Guadalupe Creek

Station 43	-	at Los Gatos Golf Course
Station 20	-	at Alamitos Recharge System
Station 16900	-	downtown San Jose

Coyote Creek

Station 9	-	below Anderson Reservoir
Station 58	-	at Edenvale

Llagas Creek

Station 69	-	below Chesbro Reservoir
Station 11158555	-	25 feet upstream of Machado School
Station 11153530	-	at San Martin Avenue

The data collected will be used to identify long term variations in quality and evaluate the effects of change in land use and other activities on the quality of water of streams in Santa Clara County.

2. Reservoirs

Since 1974, the District has been conducting liminologic investigations of the conservation reservoirs. Limnology is the study of physical, chemical, and biological conditions of a freshwater body, and its tributary streams and watershed. During 1979-80 the limnologic program consisted of sampling Anderson and Lexington Reservoir.

Anderson Reservoir has been studied in depth and is now sampled on a once-a-year frequency to detect changes in quality. A comprehensive investigation of Lexington Reservoir was completed in 1979-80. Calero Reservoir will undergo a similar in depth investigation in 1980-81.

The product of these investigations is a collection of adequate base-line water quality data for each reservoir. Evaluation of the information collected during regular monitoring and observation of water quality trends aids in the identification of sources of contamination, will aid in predicting the impact of projected land use changes in the watersheds and will be a valuable tool in the selection of reservoir operation criteria.

VI. GLOSSARY*

Acre-Foot - A measurement of volume of water equaling 43,560 cubic feet or 325,851 gallons, an amount that would cover an area of an acre, one foot deep (a football field would be covered one and a quarter feet deep).

Aquifer - A geologic formation that stores, transmits, and yields significant quantities of water to wells and springs.

Aquitard - A geologic formation which, although porous and may store large quantities of water, will not transmit water fast enough to yield an appreciable supply for a well.

Artesian Well - A well in which water is lifted by hydrostatic pressure above the land surface at the well.

Biochemical Oxygen Demand (BOD) - The quantity of oxygen consumed in biological processes that decompose organic matter in water.

Confined Aquifer - An aquifer overlain by material sufficiently impervious to retain groundwater in the aquifer under pressure.

Connate Water - Water which was entrapped in a geologic formation at the time the formation was deposited. If the formation was deposited in the ocean or a saline lake, the connate water is also saline.

Consumptive Use - Water consumed by vegetative growth in transpiration and building of plant tissue, and water evaporated from adjacent soil, from water surfaces, and from foliage. Also, water similarly consumed and evaporated by urban and nonvegetative types of land use.

Contamination - An impairment of the quality of water by micro-organisms, chemicals, sewage, or industrial waste which renders the water unfit for its intended use. In California, this means the water constitutes an actual hazard to public health (see also Pollution).

Cubic Feet Per Second (CFS) - A unit of measurement of flowing water; the number of cubic feet of water which passes a given point in a second.

Dissolved Oxygen (D.O.) - The oxygen dissolved in water. It is essential for aquatic life.

Dry Period - An historic period of years when water supply is much below normal. An example was 1929-34 when the water in northern California streams averaged only about 38 percent of normal. It has been used as the reference drought situation in much water resource planning.

Evaporation - The process by which surface or subsurface water is converted to atmospheric vapor.

---

* From Santa Clara Valley Water District's "Glossary of Terms", April, 1977.

Evapotranspiration - Water withdrawn from soil by evaporation and plant transpiration (a consumptive use).

Flood Insurance - The transfer of the risk of monetary loss due to flooding to another in accordance with the National Flood Insurance Program.

Floodplain - The relatively flat area adjoining a river or lake that may be covered by floodwater.

Gradient - The rate of change per unit of length, such as the slope of the land, stream channel, or any surface.

Groundwater - Subsurface water in saturated porous rocks and soils.

Groundwater Basin - Areas where water is stored below the ground surface.

Groundwater Recharge - The process whereby water seeps from the surface down through soil materials to become groundwater.

Groundwater Recharge Basins - Depressions where water is placed so that it can seep into the ground.

Hydrologic Cycle - The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages of precipitation, consequent runoff, streamflow, infiltration and underground movement, eventual evaporation, and reprecipitation.

Hydrology - The applied science concerned with the waters of the earth in all its states - their occurrences, distribution, and circulation through the unending hydrologic cycle.

Hydrology, Groundwater - The branch of hydrology that deals with groundwater, its occurrence, movement, replenishment, and depletion.

Imported Water - Water that is moved from one drainage basin to another. (Example: Water is moved from the Sacramento-San Joaquin Valleys through canals and pipelines into the Santa Clara Valley.)

Infiltration - The movement of water through the soil surface and into the soil.

Injection Well - Well used for introduction water into an aquifer. Technique used to stop seawater intrusion, replenish an aquifer, or dispose of cooling water.

Overdraft - The condition in a groundwater basin where the amount of water withdrawn by pumping exceeds the amount of water replenishing the basin over a long time period.

Perched Groundwater - Groundwater occurring in a saturated zone separated from the main body of groundwater by unsaturated rock (or soil).

Percolation - The movement of water, under natural pressures developed underground, through the interstices of the rock or soil.

Percolation Pond - See Groundwater Recharge Basin.

Permeability - A measure of the ability of a material to convey water.

Piezometric Level - The level to which water will rise in a well that penetrates a confined aquifer.

Point Source - Any discernible confined and discrete conveyance from which pollutants are or may be discharged.

Pollution -The addition of sewage, industrial wastes, or other harmful or objectionable material to water (see also Contamination).

Potable Water - Water which does not contain objectionable pollution, contamination, minerals, or infection and is considered satisfactory for domestic consumption.

Precipitation - The total measurable supply of water received from clouds as rain, snow, hail, or sleet.

Primary Treatment - The first major stage in wastewater treatment, usually sedimentation. Floating and settleable solids are removed in this stage.

Salinity - The concentration of salts dissolved in water.

Secondary Treatment - The second major step in wastewater treatment using biological methods to decompose the organic wastes carried by the water.

Semiperched Groundwater - Shallow groundwater overlying a body of groundwater from which it is not separated by any unsaturated alluvium (perched groundwater but not separated by an unsaturated zone from the main groundwater body; separation is achieved by the nearly impermeable nature of the perching clay layer and if the main groundwater body were drawn down, a true perching condition would result).

Spreading Dam - A low artificial barrier built in a stream to pond water to increase groundwater recharge capacity.

Subsurface Inflow - Underground waters of the hills and mountains or adjacent groundwater basins that move into the groundwater basin under consideration. This water is subsurface outflow from the hills and mountains or the adjacent grondwater basin.

Surface Diversion - The taking of water from a stream or other body of surface water into a canal, pipeline, or other conduit.

Surface Water - Water that rests on the surface of the earth, such as streams and rivers, ponds, lakes, and reservoirs.

Suspended Solids (SS) - Small particles of matter that are carried in suspension in water.

Tertiary - Treatment processes in addition to the normal secondary treatment of wastewaters. Generally, these are chemical and physical processes.

Total Dissolved Solids (TDS) - The amount of organic and inorganic matter (by weight) dissolved in a given quantity of water. It is usually stated in parts per million (ppm) or milligrams per liter (mg/l).

Treated Water - Water that has been treated to make it suitable for domestic service (see Potable Water).

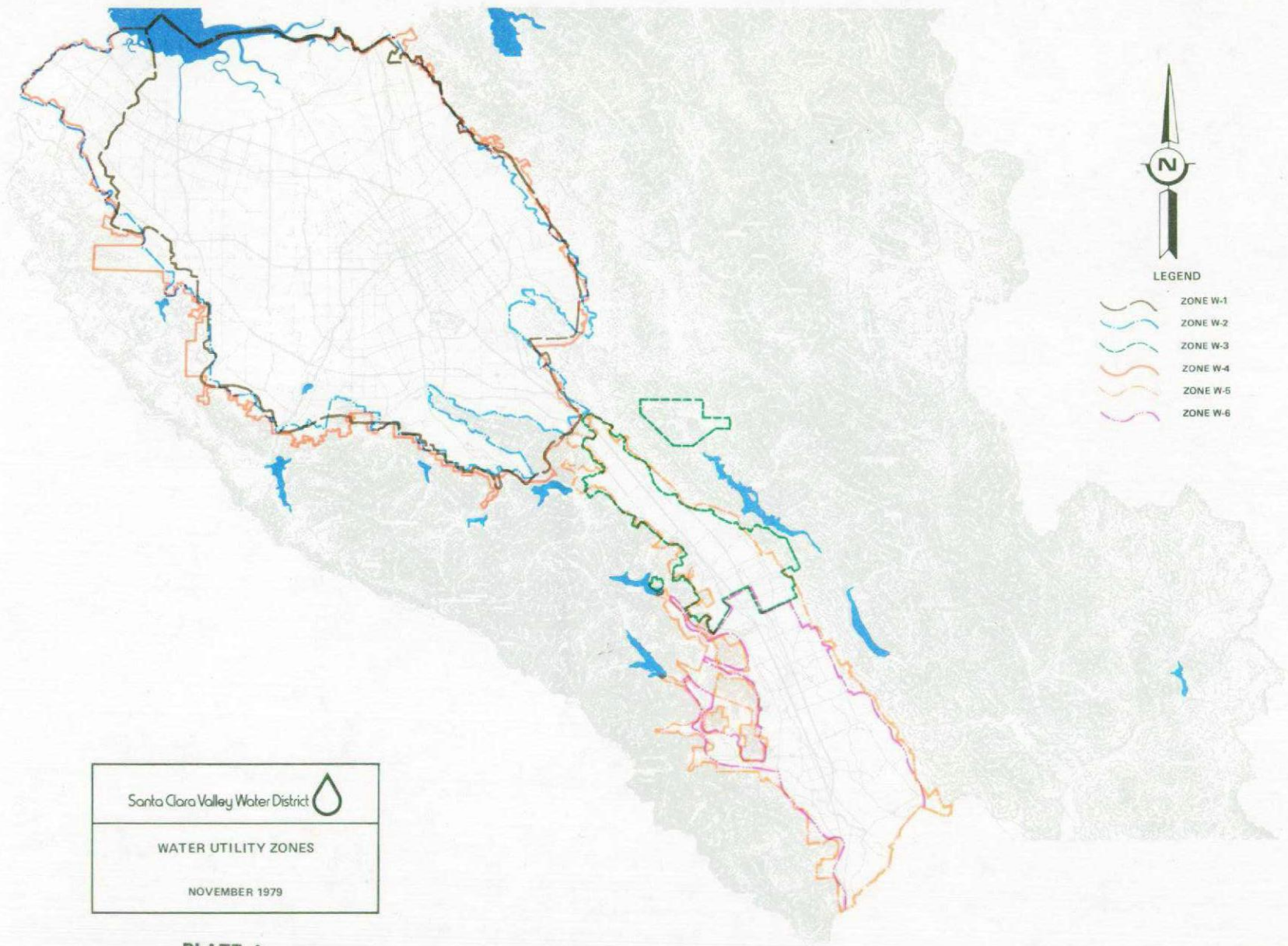
Turbidity - A measure of fine suspended matter (usually colloidal) in liquids. The fine particles may be visible as a bulk unit but are not large enough to be seen as individual particles by the naked eye; in total they restrict the passage of light through the liquid.

Unconfined Aquifer - An aquifer such that the piezometric surface of the groundwater retained within it falls below the bottom of any upper confining bed.

Water Quality - The chemical, physical, and biological properties of water which affect its suitability for use.

Watershed - The land area from which water drains to a given point (a drainage area, drainage basin, or catchment area).

Water Table - The surface where groundwater is encountered in a well in an unconfined aquifer.



Santa Clara Valley Water District

WATER UTILITY ZONES

NOVEMBER 1979

PLATE 1

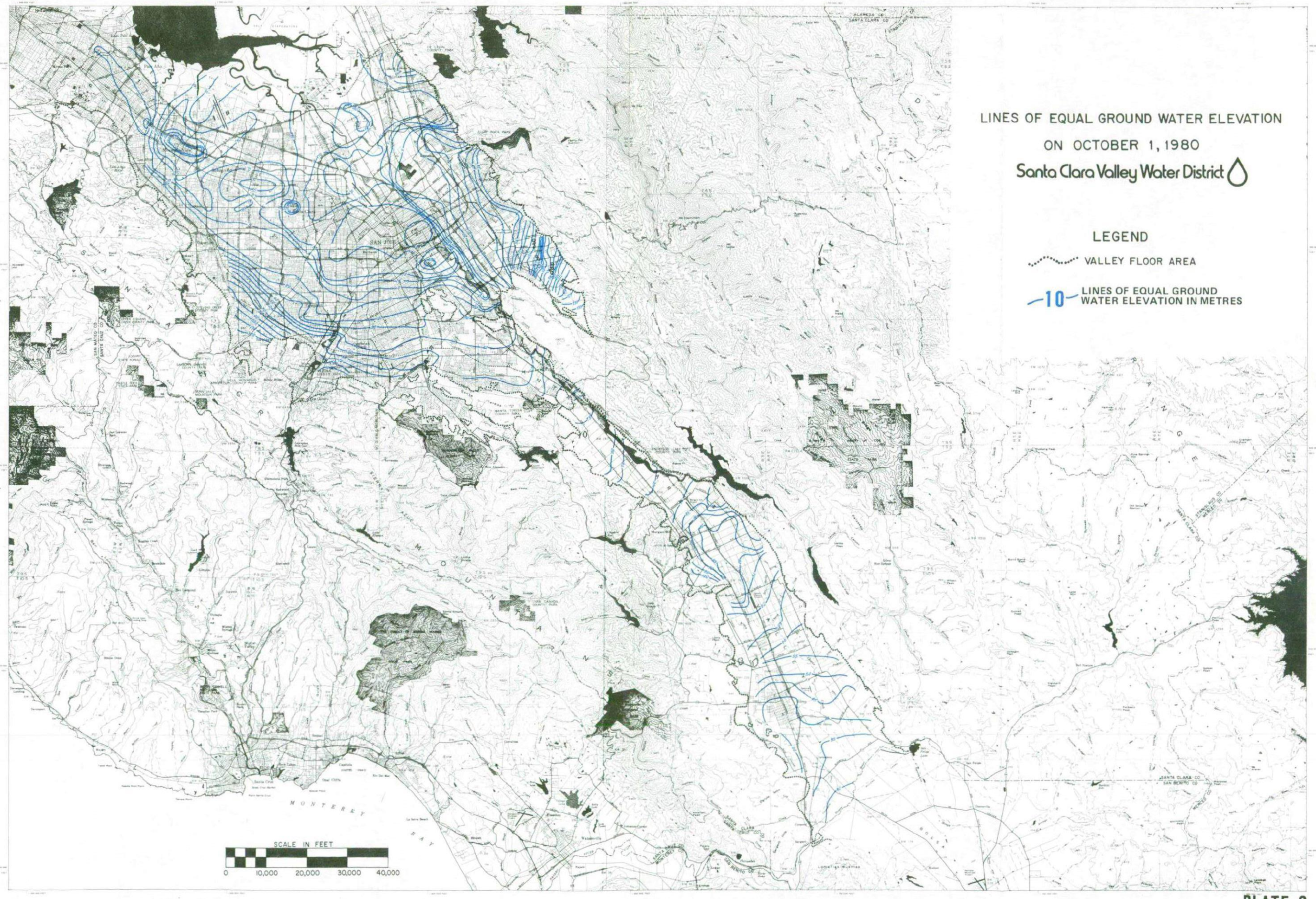

LINES OF EQUAL GROUND WATER ELEVATION
ON OCTOBER 1, 1980
Santa Clara Valley Water District
LEGEND
VALLEY FLOOR AREA
10
LINES OF EQUAL GROUND WATER ELEVATION IN METRES
SCALE IN FEET
0
10,000
20,000
30,000
40,000
MONTEREY BAY
SANTA CRUZ MOUNTAINS
SAN JOSE

PLATE 2

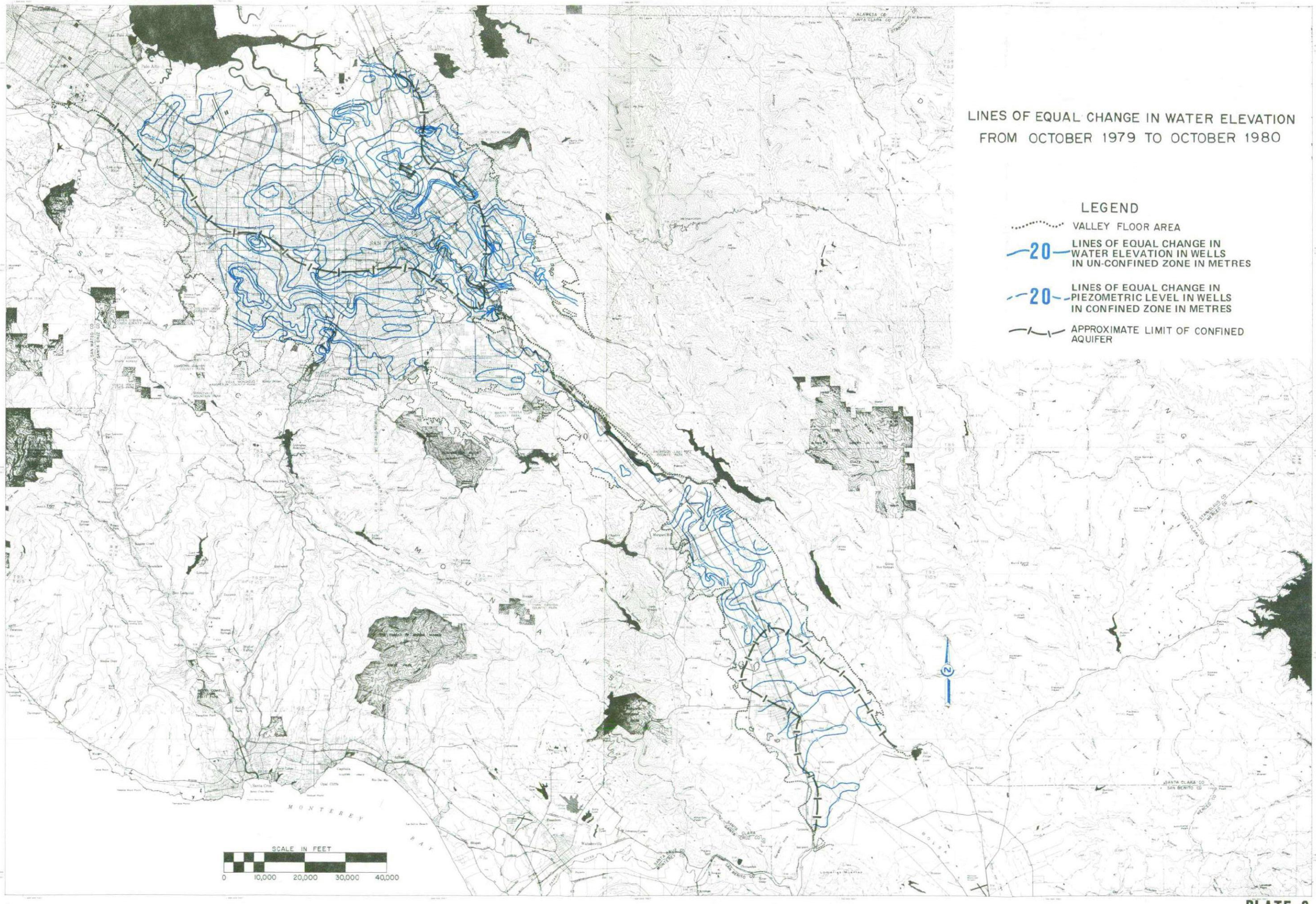

LINES OF EQUAL CHANGE IN WATER ELEVATION
FROM OCTOBER 1979 TO OCTOBER 1980
LEGEND
VALLEY FLOOR AREA
20
LINES OF EQUAL CHANGE IN WATER ELEVATION IN WELLS IN UN-CONFINED ZONE IN METRES
20
LINES OF EQUAL CHANGE IN PIEZOMETRIC LEVEL IN WELLS IN CONFINED ZONE IN METRES
APPROXIMATE LIMIT OF CONFINED AQUIFER
SCALE IN FEET
0
10,000
20,000
30,000
40,000
MONTEREY BAY
SANTA CRUZ MOUNTAINS
SANTA CLARA CO
SAN BENITO CO
SANTA CRUZ CO
MONTEREY CO
ALAMEDA CO
SANTA CLARA CO
SAN MATEO CO
SANTA CLARA CO

PLATE 3

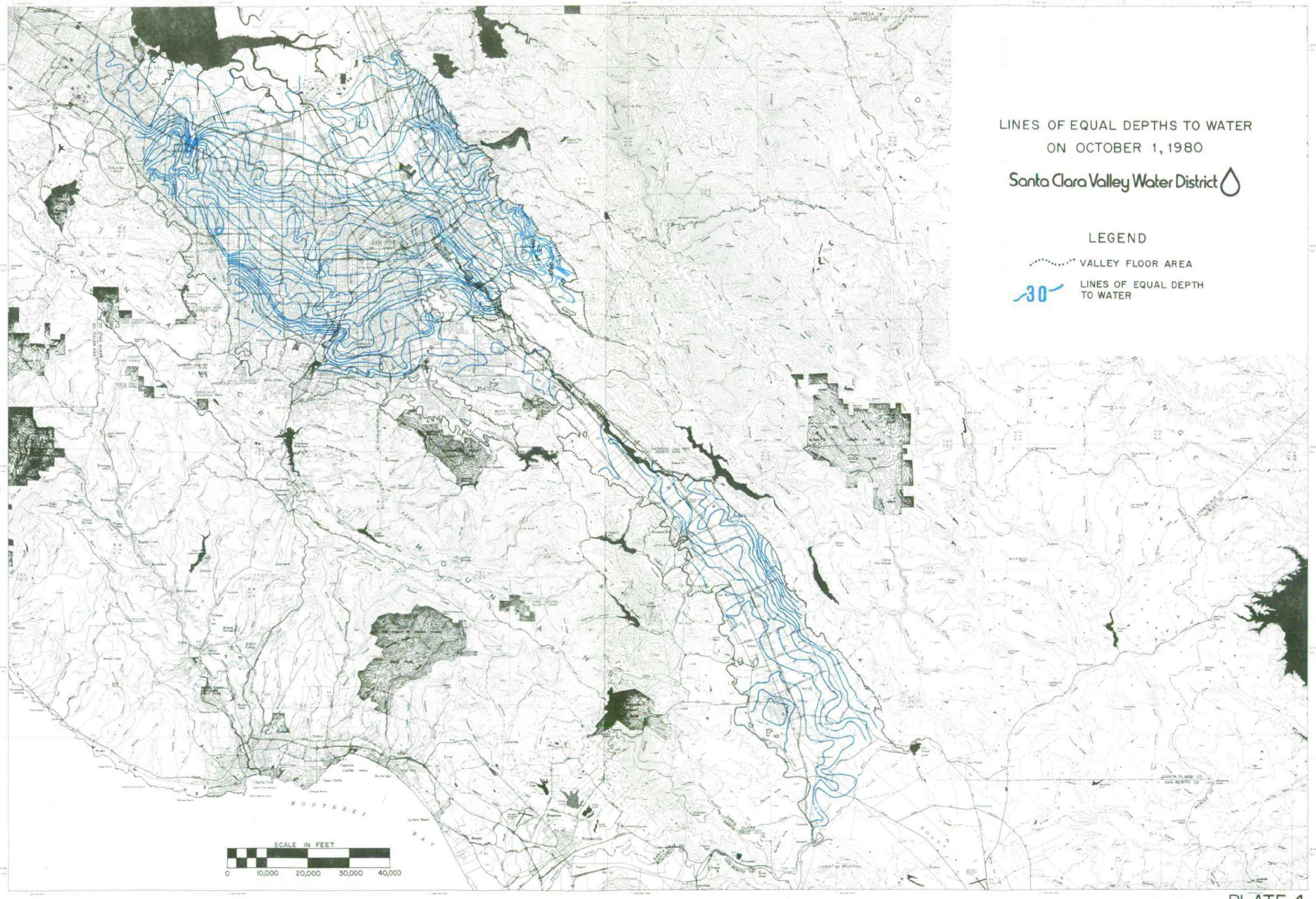

LINES OF EQUAL DEPTHS TO WATER
ON OCTOBER 1, 1980
Santa Clara Valley Water District
LEGEND
VALLEY FLOOR AREA
30
LINES OF EQUAL DEPTH TO WATER
SCALE IN FEET
0
10,000
20,000
30,000
40,000
MONTEREY
BAY

PLATE 4